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THERMAL NEUTRON ABSORPTION CROSS SECTION OF BORON

by

P. DE BIEVRE - G.H. DEBUS - J. SPAEPEN

1963

Central Bureau for Nuclear Measurements
Geel Establishment (Belgium)

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Thermal neutron absorption cross section of boron

(*Received* 19 *March* 1963)

THE thermal neutron absorption cross section of boron has been measured in several laboratories and the discrepancies were not explained on a basis of statistical error calculation (GREEN *et al.*, 1954; DERUYTTER *et al.*, 1962).

THODE *et al.* proved the variation of the isotopic concentration of boron with different geological origin and the disagreements in the cross-section values of natural boron have been partly ascribed to the boron samples used by the experimentalists of the different laboratories.

During a recent intercomparison of samples taken from stocks of boron used as a standard in nuclear institutes, we obtained, by means of mass spectrometry, a series of results which agree with previous direct intercomparisons of the same stocks by oscillation techniques (GREEN *et al.*)

Our results are given in Table 1, which indicates the ratio of the atomic boron-10 content in the sample to the atomic boron-10 content in the Harwell boric acid standard.

TABLE 1

	Mass spectrometer I	Mass spectrometer II	Average
Argonne I	0·985 ± 0·002	0·983 ± 0·002	0·984
Argonne II	0·986 ± 0·002	0·985 ± 0·002	$0{\cdot}985_5$
C.B.N.M. I	———	0·985 ± 0·003	0·985
C.B.N.M. II	0·986 ± 0·003	0·988 ± 0·002	0·987
Chalk River	0·986 ± 0·003	0·986 ± 0·002	0·986
A.E.G.	0·984 ± 0·002	0·986 ± 0·003	0·985
Fontenay (old stock)	$0{\cdot}999_5$ ± 0·002	$0{\cdot}999_5$ ± 0·002	$0{\cdot}999_5$
Fontenay (new stock)	0·997 ± 0·002	0·998 ± 0·002	$0{\cdot}997_5$

The Argonne I sample is boric acid, obtained from Wexler and Ringo, A.N.L., and was taken from the original stock used by GREEN *et al.* for cross-section measurements. This stock is now almost exhausted.

The Argonne II sample is a probe from 700 lb boric acid mixed by Merck U.S. for A.N.L.

The C.B.N.M. I sample is B_2O_3 from Merck, Germany and was used by DERUYTTER *et al.* for measurements of the thermal neutron absorption cross section of boron.

The C.B.N.M. II sample is part of 200 kg boric acid prepared by Merck, Germany and mixed by the C.B.N.M. This stock of natural boron is to be distributed by C.B.N.M. in the countries of the European Community.

The Chalk River sample is boric acid and originates from a boron standard at Chalk River, Canada.

The A.E.G. sample is a probe from a large lot of boric acid prepared by Merck, Germany.

The Fontenay 'old stock' and Fontenay 'new stock' samples are boric acid and originate probably from Turkey. The old stock has been used as a standard at Fontenay-aux-Roses, France.

The Harwell sample was boric acid.

From the present investigation, it seems worthwhile to mention the following observations:

(1) The values obtained for the atomic boron-10 content of the two Argonne samples, the two C.B.N.M. samples, the Canadian sample (Chalk River) and the A.E.G. sample (Germany) are identical within the statistical fluctuations. The quoted errors are such that the measured value has a 99 per cent probability not to exceed the indicated limits.

(2) The British (Harwell) and the two French (Fontenay 'old' and 'new') samples are significantly different in atomic boron-10 content from the others but are themselves also identical within the limits of statistical fluctuations.

This result is in agreement with the value of the ratio indicated by GREEN *et al.* of the thermal boron absorption cross section of the Argonne-Brookhaven standards to the thermal boron absorption cross section of the Harwell one, obtained by oscillation in GLEEP.

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